

Remarks

Reconsideration of this application as amended is respectfully requested.

Claims 5-7 and 13-15 stand rejected under 35 U.S.C. §112, first paragraph.

Claim 3 stands rejected under 35 U.S.C. §112, second paragraph.

Claims 1-5, 8-13, and 18 stand rejected under 35 U.S.C. §102(b) as being unpatentable over U.S. Patent No. 5,933,853 of *Takagi* ("*Takagi*").

Claims 6-7, and 14-15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Takagi* and U.S. Patent no. 6,253,290 of *Nakamoto* ("*Nakamoto*").

Claims 16 and 17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Takagi* and U.S. Patent no. 6,324,632 of *McIntosh-Smith* ("*McIntosh-Smith*").

Claim 19 stands rejected under 35 U.S.C. §103(a) as being unpatentable over *Takagi* and an excerpt from a publication entitled *How Computers Work*, by White, R., ("*White*").

The Examiner has objected to the term "Success" used in reference 76 of Figure 3 of the drawings. In response, applicants provide herewith an amended Figure 3 that replaces "Success?" with "Eviction Successful?" for clarity and consistency with page 11, lines 18-22 of the Specification.

The Examiner has objected to the Specification and has stated that the disclosure does not provide a description of the shared status replacement policy as claimed in claims 6-7 and does not provide a discussion of eviction failure as claimed in claims 5 and 13. The Examiner has rejected claims 5-7 and 13-15 under 35 U.S.C. §112, first paragraph, for similar reasons.

Applicant's respectfully submit that the shared status of a data block and replacement policy based on such status is described in the Specification. For example, the Specification states that

In addition, the cache controller in the storage system 20 may preferentially keep data blocks in the storage system cache 22 that are being shared by multiple host systems that have access to the storage system 20. (Specification, page 9, lines 8-12) (Emphasis added) and that

For example, the cache controller may select data blocks for eviction from among the unshared data blocks only and select shared data blocks for eviction only if no unshared data blocks remain in the storage system cache 22.

(Specification, page 9, lines 12-16) (Emphasis added) and that Alternatively, the cache controller may take into account the shared status of a data block as only one factor in its replacement policy with other factors being the age, time of last update, etc., for the data block. These factors may be weighted in any combination. (Specification, page 9, lines 16-22) (Emphasis added).

Applicants also submit that eviction failure is described in the Specification. For example, the Specification states that

If space is not available in the storage system cache 22 for the demoted data block 52 at step 70, then at step 74 an attempt is made to evict a data block from the storage system cache 22. If a data block was successfully evicted from the storage system cache 22 then at step 80 the demoted data block 52 is written into the newly freed entry in the storage system cache 22. Otherwise, the demoted data block is discarded at step 78.

(Specification, page 11, lines 15-23). (See also references 74 and 76 of Figure 3 of the drawings).

It is therefore respectfully submitted that the Specification provides support for claims 5-7 and 13-15 for the purposes of 35 U.S.C. §112, first paragraph.

The Examiner has rejected claim 3 under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner has stated that it is unclear as to the difference between a demote operation and a write operation. Applicants submit that amended claims 1 and 3 eliminate any ambiguity.

The Examiner has rejected claims 1-5, 8-13, and 18 under 35 U.S.C. §102(b) as being unpatentable over *Takagi*. Applicants respectfully submit, however, that amended claim 1 is not anticipated by *Takagi*. Amended claim 1 is a method for

exclusive caching in a computer system that includes the limitations

performing a read operation to obtain a set of information from a storage system in the computer system such that the information is not stored in a storage system cache in the storage system and is stored in a host cache in response to the read operation;

performing a demote operation if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in the storage system cache in response to the demote operation.

(Amended claim 1) (Emphasis added).

Takagi does not disclose a read operation in which information from a storage system is stored in a host cache but not in a storage system cache as claimed in amended claim 1. Instead, Takagi discloses a system in which information read from a storage system, an optical disc, is stored in both a storage system cache, a cache HDD 5 (Takagi, col. 4, lines 34-36) and a cache memory 4 associated with a CPU (Takagi, col. 9, lines 44-47).

In further contrast, Amended claim 1 includes the limitations

performing a read operation to obtain a set of information from a storage system in the computer system such that the information is not stored in a storage system cache in the storage system and is stored in a host cache in response to the read operation;

performing a demote operation if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in the storage system cache in response to the demote operation.

(Amended claim 1) (Emphasis added).

Takagi does not disclose a demote operation that removes information from a host cache to a storage system cache if the information is clean as claimed in amended claim 1. Instead, Takagi discloses a system in which information removed from a cache memory 4 is discarded if it is clean. For example, Takagi teaches that

In staging out data from the cache memory 4 to the cache HDD 5, only when the data is dirty or highly-

frequently accessed and not stored in a highly-frequently accessed optical disc 24, it is written into the cache HDD 5. In other cases, writing is not effected and the data is just discarded. Here, data subjected to modifications is defined as dirty and data subjected to no modifications in the CPU 1 is defined as clean. (Takagi, col. 5, lines 22-29) (Emphasis added).

It is therefore respectfully submitted that the method of amended claim 1 that includes a read operation in which information from a storage system is stored in a host cache but not in a storage system cache and a demote operation that removes information from a host cache to a storage system cache if the information is clean is not anticipated by the system of Takagi which stores data read from an optical disc in both caches and which discards data from a host cache if it is clean.

Given that claims 2-7 depend from amended claim 1, it is submitted that claims 2-7 are not anticipated by Takagi.

Applicants further submit that amended claim 8 is not anticipated by Takagi. Amended claim 8 is a computer system that includes limitations similar to the limitations of amended claim 1 including means for reading a set of information from a storage system such that the information is not stored in a storage system cache and is stored in a host cache and means for demoting the information if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in a storage system cache. Therefore, the remarks stated above with respect to amended claim 1 also apply to amended claim 8.

Given that claims 9-19 depend from amended claim 8, it is submitted that claims 9-19 are not anticipated by Takagi.

The Examiner has rejected claims 6-7 and 14-15 under 35 U.S.C. §103(a) as being obvious in view of Takagi and Nakamoto. Amended claims 1 and 8 from which claims 6-7 and 14-15 depend are not obvious in view of Takagi because Takagi does not teach or suggest reading a set of information from a

storage system such that the information is not stored in a storage system cache and is stored in a host cache and demoting the information if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in a storage system cache. *Nakamoto* discloses a multi-processor system that avoids write monitoring of a cache (*Nakamoto*, col. 3, lines 60-65) rather than reading a set of information from a storage system such that the information is not stored in a storage system cache and is stored in a host cache and demoting the information if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in a storage system cache as claimed in claims 6-7 and 14-15.

The Examiner has rejected claims 16 and 17 under 35 U.S.C. §103(a) as being obvious in view of *Takagi* and *McIntosh-Smith*. As shown above, amended claim 8 from which claims 16 and 17 depend is not obvious in view of *Takagi*. *McIntosh-Smith* discloses a partitioning of a cache (*McIntosh-Smith*, col. 1, line 66 through col. 2, line 3) rather than reading a set of information from a storage system such that the information is not stored in a storage system cache and is stored in a host cache and demoting the information if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in a storage system cache as claimed in claims 16 and 17.

The Examiner has rejected claim 19 under 35 U.S.C. §103(a) as being obvious in view of *Takagi* and *White*. As shown above, amended claim 8 from which claim 19 depends is not obvious in view of *Takagi*. *White* teaches backing up a hard drive rather than reading a set of information from a storage system such that the information is not stored in a storage system cache and is stored in a host cache and demoting the information if the information is clean when

evicted from the host cache such that the information is not stored in the host cache and is stored in a storage system cache as claimed in claim 19.

It is respectfully submitted that in view of the amendments and arguments set forth above, the applicable objections and rejections have been overcome. The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 08-2025 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

Date: 12-2-02

By: Paul H. Horstmann
Paul H. Horstmann
Reg. No.: 36,16

Version with Markings to Show Changes Made

1. A method for exclusive caching in a computer system, comprising the steps of:

performing a read operation to obtain [reading] a set of information from a storage system in the computer system such that the information is not stored in a storage system cache in the storage system and is stored in a host cache in response to the read operation;

[storing the information in a host cache in the computer system;]

performing a demote operation if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in the storage system cache in response to the demote operation [demoting the information from the host cache to a storage system cache in the storage system].

2. The method of claim 1, wherein the step of [demoting] performing a read operation comprises the step of evicting the information from the storage system cache if stored in the storage system cache [steps of:

evicting the information from the host cache;

transferring the information to the storage system in a demote operation on a communication path between the host cache and the storage system].

3. The method of claim [2] 1, wherein the step of performing a demote operation comprises the step of storing the information in any free area of the storage system cache [transferring the information to the storage system in a demote operation is performed only if the information is not dirty and the step of transferring the information to the storage system in a write operation is performed otherwise].

4. The method of claim [2] 1, wherein the step of performing a demote operation comprises the step of storing the information in a predetermined sub-area of the storage system cache [further comprising the step of storing the information carried in the demote operation into the storage system cache].

5. The method of claim [4] 1, wherein the step of performing a demote operation [storing the information carried in the demote operation into the storage system cache] comprises the steps of:

performing an eviction from the storage system cache;
discarding the information if the eviction fails.

8. A computer system, comprising:

storage system having a storage media and a storage system cache;

host system having a host cache;

means for exclusively caching a set of information obtained from the storage media such that the information is stored either in the host cache or the storage system cache but not both caches at the same time wherein the means for exclusively caching includes means for reading the information from the storage system such that the information is not stored in the storage system cache and is stored in the host cache and means for demoting the information if the information is clean when evicted from the host cache such that the information is not stored in the host cache and is stored in the storage system cache.

9. The computer system of claim 8, wherein the means for reading includes means for evicting the information from the storage system cache if stored in the storage system cache [exclusively caching includes means for evicting the information from the host cache and transferring the

information to the storage system in a demote operation on a communication path between the host cache and the storage system].

10. The computer system of claim [9] 8, wherein the means for exclusively caching includes [communication path is] a bus in the computer system.

11. The computer system of claim [9] 8, wherein the means for exclusively caching includes [communication path is] a network communication link in the computer system.

12. The computer system of claim [9] 8, wherein the means for demoting includes means for storing the information in any free area of the storage system cache [exclusively caching further includes means for storing the information carried in the demote operation into the storage system cache].

13. The computer system of claim [12] 8, wherein the means for demoting includes [storing the information carried in the demote operation into the storage system cache includes] means for performing an eviction from the storage system cache and discarding the information if the eviction fails.